Assistance Agreement Quarterly Report Summary: 15th and16th Quarters

Date of Report: June 4, 2004

Agreement No: R82806301

Title: **Baltimore Supersite: Highly Time and Size Resolved Concentrations of Urban PM2.5 and its Constituents for Resolution of Sources and Immune Responses**

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Institution: Department of Chemistry and Biochemistry, University of Maryland, College Park, MD

Research Category: Particulate Matter Supersites Program

Project Period: January 15, 2000 to December 31, 2005

Objectives of Research: Our primary objectives are to i) provide an extended, ultra high-quality multivariate data set, with unprecedented temporal resolution, designed to take maximum advantage of advanced new factor analysis and state-of-the-art multivariate statistical techniques; ii) provide important information on the potential for health effects of particles from specific sources and generic types of sources, iii) provide large quantities of well characterized urban PM for retrospective chemical, physical, biologic analyses and toxicological testing, iv) provide sorely needed data on the sources and nature of organic aerosol presently unavailable for the region, v) provide support to existing exposure and epidemiologic studies to achieve enhanced evaluation of health outcome-pollutant and -source relationships, and vi) test the specific hypothesis listed in our proposal.

ACTIVITIES AND FUTURE PLANS

During the current report period the following activities were performed.

1. **NARSTO submissions.** Previously, all data collected in 2001 (Clifton and FMC sites) and all LIDAR (all sites) have been submitted to the NARSTO archive. Files for the TEOM, sulfate, nitrate,

and OC/EC data have been prepared for submission during this report period. There are minor details yet to complete such as detection limits, but these files should be submitted to the database shortly. Work is continuing on the APS, and SMPS data and these should be ready in approximately two weeks. There are remaining formatting issues with the Drum impactor data and discussions on this problem are on-going.

2. **Publications.** Most of our effort during this reporting period has been devoted to preparation of manuscripts for publication in the Supersites special issues as well as other journal venues. The following manuscripts have been submitted or accepted for publication during the first and second quarters of 2004. An asterisks indicates either a new paper or a change in status since the last report period.

*Park, S. S., Pancras P. J., Ondov, J. M., Poor, N. A New Pseudo-deterministic Multivariate Receptor Model for Accurate Individual Source Apportionment Using Highly Time-resolved Ambient Concentrations Measurements, Special Supersites issue of the *Journal of Geophys. Research*, submitted.

*Seung Shik Park, Jan Kleissl[1], David Harrison, Narayanan P. Nair, Vijayant Kumar[1] and John Ondov, Investigation of $PM_{2.5}$ Episodes Using semi-continuous Instruments at the Baltimore Supersite at Ponca St., Special Supersites issue of the *Journal of Geophys. Research*, submitted.

Highly-time resolved particulate nitrate measurements at the Baltimore Supersite, by Harrison, D., Park, S. S., Ondov, J. M., Buckley, T., Kim, S. R., Jayanty, R. K. M., submitted to Atmospheric Environment. This one has been reviewed and has probably been accepted.

*Seung Shik Park, David Harrison, Patrick, J. Pancras, and John M. Ondov, Highly Time-Resolved Organic and Elemental Carbon Measurements at the Baltimore Supersite in 2002. Special Supersites issue of the *Journal of Geophys. Research*, reviewed and resubmitted.

*Michael P. Tolocka, Derrek A. Lake, Murray V. Johnston, and A. S. Wexler. Size resolved fine and ultrafine particle composition in Urban Air. Submitted to the special JGR issue in January 2004.

Mariana Adam, Markus Pahlow, Vladimir A. Kovalev, John M. Ondov, Marc B. Parlange, Aerosol optical characterization by nephelometer and lidar during the Baltimore PM Supersite, 4 - 12 July 2002, accepted for publication in* JGR Atmospheres.

*M. Pahlow, J. Kleissl, M. B. Parlange, J. M. Ondov and D. Harrison, Atmospheric boundary layer structure as observed during a haze event due to forest fire smoke. Boundary Layer Meteorology, accepted.

*M.P. Tolocka, D.A. Lake, M.V. Johnston, A.S. Wexler Ultrafine nitrate particle events in Baltimore observed by real-time single particle mass spectrometry, *Atmos. Environ. 38*:3215-3223, 2004.

*M.P. Tolocka, D.A. Lake, M.V. Johnston, A.S. Wexler, Concentrations of fine and ultrafine particles containing metals *Atmos. Environ., 38*:3263-3273, 2004.

*Begun, B.A.; Hopke, P.K., Zhao, W. (2004) Source identification of fine particles in Washington DC by expanded factor analysis modeling, *Environ. Sci. Technol.* (Revised version resubmitted May 22, 2004).

*Paatero, P.; Hopke, P.K. 2002. Utilizing Wind Direction and Wind Speed as Independent Variables in Multilinear Receptor Modeling Studies, *Chemo. Intel. Lab. Systems* 60, 25-41.

*Zhou, L.; Hopke, P.K.; Paatero, P.; Ondov, J.M.; Pancras, J.P.; Pekney, N.J.; Davidson, C.I., 2004. Advanced Factor Analysis for Multiple Time Resolution Aerosol Composition Data, *Atmospheric Environ.* (Revised version submitted May 22, 2004).

Drafts of manuscripts, submitted or in preparation may be downloaded from:
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We continue to prepare manuscripts for publication based on individual investigator results and are beginning to develop integrated, multi-investigator data analyses.

We expect to submit the following new manuscripts for publication in the next quarter:

UMCP: *P. Pancras, Y. C. Chang, J. M. Ondov, T. Tuch, S. Gazula, Sub-hourly Metals Measurements at US Supersites with SEAS II. In preparation for submission to Environ. Sci. Technol.

*Park, S. S., Harrison, D., Ondov, J. M., Seasonal and short-term variations in Nitrate concentrations. Seasonal and short-term variations in Nitrate concentrations, in final stages of preparation.

Clarkson: Baltimore Supersite: Highly Time and Size Resolved Concentrations of Urban Pm2.5 and its Constituents for Resolution of Sources and Immune Responses

J.M. Ondov, T.J. Buckley, P.K. Hopke, M.B. Parlange, W. F. Rogge, K. S. Squibb, M.V. Johnston, and A. S. Wexler,

UDE/UD: M. P. Tolocka et. al., Particle classes in Baltimore, to be submitted by the end of January to the special JGR issue.

UMAB: Mitkus R. J, Powell J. L, Ondov, J. M., Pancras, J. P. and Squibb KS. Baltimore $PM_{2.5}$ daily and seasonal variations in *in vitro* stimulated chemokine and cytokine release: Correlation with metal content. In preparation

JHU: *J. Kleissl, M. Adam, V. Kumar, M. Pahlow, J. Ondov, M.B. Parlange, Meteorologial conditions conducive to elevated PM2.5 concentrations during the Baltimore Supersite Experiment in 2002.

3. **Data loading.** We are reconfiguring tables in the Baltimore Supersite Database for the aerosol spectrometer (SMPS and APS) data. A limitation to the number of columns allowed in a pivot table query in SQL server 2000 makes it impossible to search on individual size ranges. The tables are being reconfigured to circumvent this problem.

4**. SIRD.** All NOAA profiler data have been loaded. All AQS data have been reviewed and tested for logical consistency of data types in fields to be imported. These data are currently being loaded into SIRD. About two-thirds of the data from LA, and most of the data from New York, Fresno, and Atlanta, and all of the Pittsburgh data have been loaded. Most of the Baltimore Supersite data have been loaded into the NARSTO format and are ready for submission. A number of supersites files are awaiting clarification and recategorization required for loading. Status of the data being loaded can be viewed at http://supersitesdata,umd.edu/sysInfo.htm.

5. SEAS. A High Efficiency Particulate (HEPA) filter capsule was connected at the inlet of SEASII for system-blank sampling. As the system became free of particles, volume of blank sample was negligibly small at the target RH at which SEAS is operated. Therefore, homogenous nucleation of water droplets was forced in SEAS II by raising target RH value. Above a certain saturation ratio (>3.0), the system-blank volume was considerable, ranging between 2 and 6 ml, but with less control on sample production rate. The ultimate use of this system blank data was initially not realized, as the excess volume needed to be accounted for in the concentration calculations.

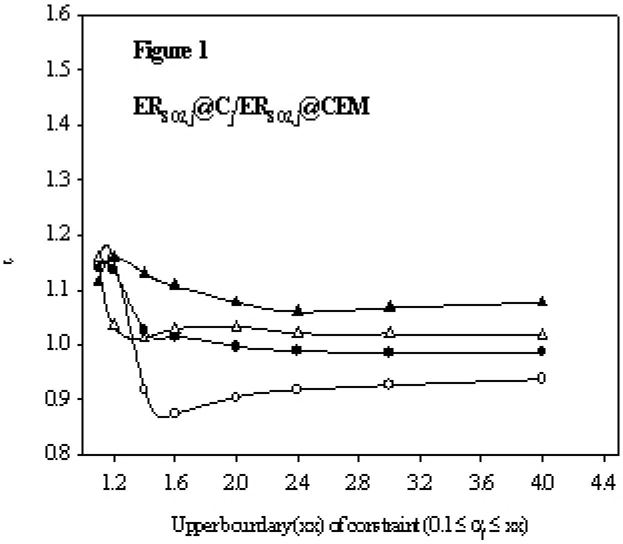
Analysis of over 100 field system-blank samples from all sites revealed that elements such as As, Se, Cd, and Pb, were mostly at or below the instrument detection limits of the analytical platform (GFAASZ) employed for the metals determination in the slurry sample. It is known that these metals are predominately found in ultrafine particles, and therefore readily solubilized in the

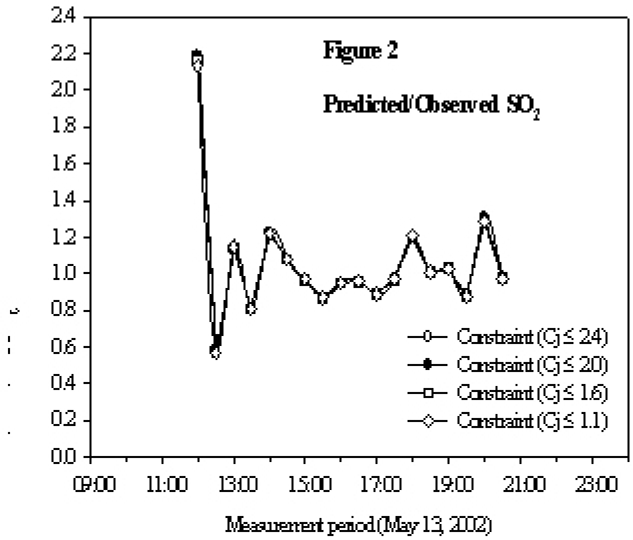
nucleation stage itself and transported efficiently to the collection assembly. However, concentrations of Ni, Al, Fe, Zn and Cr in field blanks were significant, ranging 2-20 times of laboratory system-blanks. The field system-blank concentrations of these metals decreased gradually as the number of successive blanks increased. This observation suggested that a small fraction of water-insoluble particles, presumably silicates, got retained in the VI and drain solenoid valve paths of SEAS II. Over a period of continuous operation, the accumulated particles at the drain valve resulted this 1mm-id valve fail. Blanks performed immediately after the replacement with new valves had concentrations similar to laboratory system blanks.
It was perceived that when a HEPA filter capsule was connected for field blanks, excess pressure drop developed inside the system forced the adhered particles migrate from the valves. The uncontrolled water production under homogeneous nucleation condition aided leaching. Therefore, numerical correction is practically not possible as the extent of leaching and composition of settlement at the valves vary beside unknown steam input for driving a homogeneous nucleation. The field system-blank samples collected in all sites are, therefore, not useful in defining detection limits. Instead, they are simply a product of system cleaning. As a result, ambient concentrations of elements determined by SEAS II were used as such with out any blank corrections. The solenoid valves in SEAS II are now replaced with large-bore ball valves. Field blanks analysis partly explains lower and inconsistent efficiencies for Al, Fe, Cr, and Ni (results discussed in the following section).

The detection limit of metals by SEAS II was calculated from the laboratory system-blanks produced by Target RH method. Four successive samples were collected, weighed separately, and then combined as a single sample and analyzed. Minimum detection limits (in ng/m^3)obtainable by SEAS II are as follows: Al, 1.9, As 0.004, Cd, 0.015; Cr, 0.019; Cu, 0.53; Fe, 0.24; Mn, 0.07; Ni, 0.084; Pb, 0.15; Se, 0.002; and Zn, 3.6. Variability in the MDLs arises mainly from sample collection volume.

6. MULTIVARIATE DATA ANALYSIS

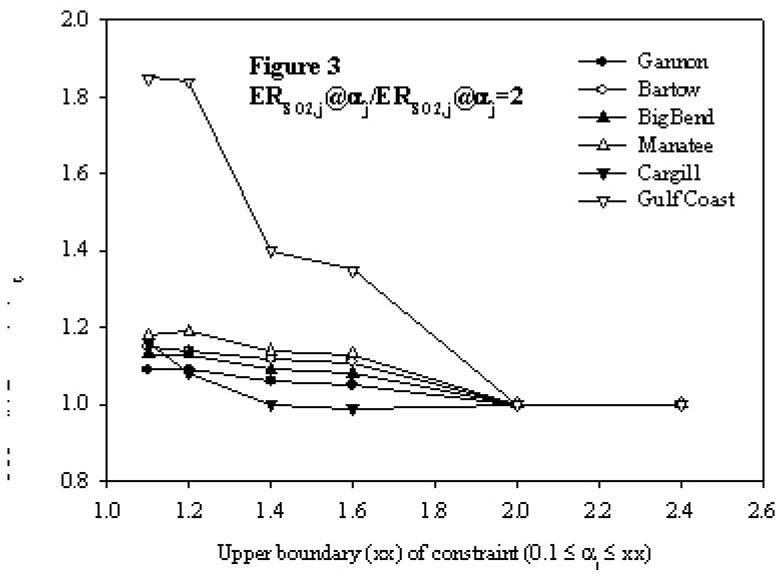
UMCP Pseudo-Deterministic Receptor Model. During the last quarter of 2003, UMCP developed a new multivariate pseudo-deterministic hybrid receptor model to resolve the contributions of pollutants from individual stationary sources using ambient measurements made at temporal provided by the UMCP SEAS. In the model ambient concentrations are reconciled against the products of their emission rates and atmospheric dispersion factors for individual sources in a receptor equation, wherein values of the latter are estimated from a Gaussian plume model and used to constrain the solutions. In contrast to factor analysis models, the new hybrid model explicitly uses knowledge of wind direction in relation to that of the known sources, as well as other plume dispersion variables, yet preserves the robustness of a least-squares fit to the ambient data.
In the current report period, we have completed simulations to determine the sensitivity of the model to values of the constraint to the upper bound of the range in which the model is directed to find solutions to the meteorological dispersion factor. This was done by changing constraints range ($0.1 \le \alpha_j \le xx$; xx =1.1-8.0). This was done for model results for which identical constraints were uniformly applied to all 6 sources; and also by applying the constraints as





described in the original manuscript, i.e., wherein we magnified the upper bound constraints for the small plants by factors of 4 and 12. Results of the first sensitivity analysis are shown in Figures 1 and 2. Figure 1 shows the variation in ratio of the predicted SO_2 emission rate to observed average rates (CEM) as a function of the upper bound of the constraint. The predicted SO_2 emission rates for Cargill and Gulf coast recycling plants are not shown in this figure because CEM data for these two plants are not available. As shown in the Figure 1, there is little change in ratio of the observed- and predicted SO_2 emission rates for α_j values exceeding 2.0. The ratios below α_j of 2.0 increased slightly with decreasing in upper boundary of α_j, ranging from 0.88-1.16 depending on the stationary point sources, but this gives a variation in the predicted results of at most 16%, so clearly their solution is not highly sensitive to the constraint range. The results suggest that a larger upper bound should generally be chosen. As shown in Figure 2, the sensitivity of predicted ambient SO_2 concentrations are clearly not sensitive to different constraint ranges less than 2.0. To save space we elect not to show Figure 2 in the manuscript. Overall, these results confirm that the model is not highly sensitive to the constraint ranges, but best results for the four large plants were obtained for the constraint range, $0.1 \le \alpha_j \le 2.0$.

As discussed above, there are good reasons to expand constraints applied to the X/Q's for Cargill and Gulf Coast. Figure 3 shows the



sensitivity of the emission rates for all 6 plants as a function of constraint upper bound, wherein upper bounds for Cargill and Gulf Coast are set to 4- and 12-times the upper bounds for the base constraint that we set for the other plants. In this figure, the predicted emission rates are normalized to those calculated for the base constraint = 2 (i.e., for which upper bounds for X/Q^{PDRM} are 2*4 =8 and 2*12=24 for Cargill and Gulf Coast. For values of the base constraint >2, there is no change in the predicted values, whatsoever, for any of the plants. As the upper bound of the base constraint is decreased from 2 to 1.1, predicted emissions change by <20% for all plants except Gulf coast. Clearly, the choice of constraint is most sensitive for Gulf Coast, but given that there is little change in model predictions for upper bounds > 2 x 12, and that the emission rate predicted at this upper bound is in better agreement with the annual emission rate, this would seem a logical choice. As noted above, it does, arguably, lead to better agreement between predicted and observed values for the larger plants.

Future Plans. We have now applied the model to Pittsburgh SEAS data. We intend to apply the model to our somewhat more complex Baltimore Supersite data during the next quarter.

Clarkson Analysis of Data from Different Sampling Time Intervals. Clarkson has been exploring the use of expanded factor analysis models for analyzing the data developed during the supersite program. They have continued to explore the use of the expanded model first proposed by Paatero and Hopke (2002). The complete expanded model consists of the basic bilinear equation and a multilinear equation specifying the physical model:

$$x_{ij} = \sum_{k=1}^{p} g_{ik} f_{kj}^{t} + e_{ij}$$

$$x_{ij} = \sum_{k=1}^{p} S(\eta_i, k) W(\omega_i, k) \left(\sum_{k=1}^{24} D(\delta_{ik}, k) V(v_{ik}, k)\right) f_{kj}^{t} + e_{ij}'$$

where g_{ik} are the mass contributions of source k to sample I. The source composition profiles, f_{ij}^{t}, are the same in both equations. **D** and **V** represent matrices for wind direction and speed, consisting of unknown values to be estimated during the model fitting process. Wind direction or speed are not used directly in the model but are used to select index values, δ_i and v_i. $S(\eta_i, k)$ is the element of seasonal effects matrix **S** with the index values η_i corresponding to the time-of-year classification of the *ith* day for the *kth* source. $W(\omega_i, k)$ is the element of matrix **W** with the index values ω_i corresponding to weekend/weekday factor of the *ith* day for the *kth* source. The weekend effect matrix **W** has dimension 1 by *p*. Typically, the weekend day coefficients are fixed at unity so that only the weekend coefficients are variable. This model has been tested by applying it to the IMPROVE data from Washington, DC in order to provide a historical framework to the $PM_{2.5}$ composition in the area. The results of these analyses are described in a manuscript (Begum et al, 2004) that is currently under review at *Environmental Science and Technology*.

They have also developed a factor analysis method for source apportionment that utilizes aerosol compositional data obtained with various temporal resolution (Zhou *et al.*, 2004). The data used in that study had time resolution ranging from 10 minutes to 1 hour. In this work, we test this expanded model using a rich data set from the Ponca Street site of the Baltimore Supersite with time resolution ranging from 30 minutes to 24 hours. The nature of this data set

implies that traditional eigenvalue-based methods can not adequately resolve source factors for the atmospheric situation under consideration. Also, valuable temporal information is lost if one averaged or interpolated data in an attempt to produce a data set of the identical time resolution. We, therefore, use each data point in its original time schedule and average the source contributions to correspond to the specific sampling time interval. Adjustments are made to the weights of the 24 hour data to improve data fitting to the model. The results of this modeling approach are still being refined, and we expect to have a manuscript ready to submit for publication in the near term future.
Future Plans. We will continue to acquire and load Supersites and remaining non-supersites data.

7. 3-HR RESOLUTION OF ORGANIC COMPOUNDS
Sample analysis continues. Completion of analyses and adjustments for blanks is to be completed in November, 2004.
Manuscripts planned. We are getting a lot of ambient data that cannot be summarized in just one paper. The plan is to produce approximately 4 papers dealing with summer, winter, seasonal, and correlations with other environmental parameters, etc. Another batch of papers should then be written, including some of your data and data from others, that can highlight source contributions to the sampling site and atmospheric conversion of organic matter. Lastly, a manuscript entitled, Sequential Organic Sampler for 3-hr Time Resolved Organic Species Measurements, Yu Chen Chang, W. Rogge, J. M. Ondov, is being prepared.

8. **Highlights of Selected Manuscripts (PM EPISODES IN BALTIMORE). As** described in previous reports, highly time-resolved measurements of $PM_{2.5}$, nitrate, sulfate, and elemental and organic carbon (EC and OC) were made at intervals ranging from 10 minutes to 1 hour from February 14th through the end of November, 2002, at the Baltimore Supersite at Ponca St. using commercial and prototype semi-continuous instruments. Additionally, particle size distributions (9 nm to 20 µm), criteria gas (CO, NO/NO_2, and O_3), and meteorological data were measured at 5-10 minutes intervals. Objectives of this study are to identify $PM_{2.5}$ pollution events, characterize their chemical components, and investigate their origins. During the entire study period, a total of 13 $PM_{2.5}$ pollution episodes, each in which 24-h averaged $PM_{2.5}$ mass concentrations exceeded 30.0 $\mu g/m^3$ for one or more days, were observed. The 24-h averaged $PM_{2.5}$ mass exceeded the 24-h averaged US EPA NAAQS of 65.0 g/m^3 on July 7, and was at the standard on June 25th. Eight of the 13 episodes were regional haze sulfate events with high O_3 conditions, while four were strongly associated with local traffic emissions under air stagnation, strong low-level inversions, and high relative humidity (RH) conditions, and were characterized by high OC, EC, CO, NO_x, and sometimes nitrate levels. Herein, 6 of these events (A-F) of them are discussed. Events A, C, and E were associated with regional transport and elevated ozone concentrations; Event B was caused by the Canadian Boreal Forest Fires in July 2002. Event D was associated with high ozone and reflected a mixture of regional transported and local traffic emissions. Event F was associated with local traffic during stagnation. During these various events, excess $PM_{2.5}$ was often largely due to elevations in the concentration of one or two of the major species. The most pronounced features during the regional haze events (A, C, D, and E)

were multi-day incursions of air masses with elevated sulfate concentrations. For example, in Episodes A, C, and D, maximum hourly sulfate (assumed to be ($(NH_4)_2SO_4$) accounted for up to ~80% of the maximum hourly $PM_{2.5}$ mass. Organic matter, accounting for up to 60% of the $PM_{2.5}$ mass, was the second largest contributor in these episodes. Short-term excursions in OC, EC, nitrate, CO, and NO_x levels were often observed in the morning hours. During the Canadian smoke episode (B), hourly OC accounted for up to ~92.4% of the $PM_{2.5}$ mass. $PM_{2.5}$ mass and OC were strongly correlated with particle (0.48-20.0 m) number concentrations (R^2 of 0.990 and 0.989, respectively). During event F, when stagnation conditions were accompanied by an extremely stable low-level inversion and very high RH, the second highest hourly $PM_{2.5}$ excursion (87 g/m^3) for the entire 9.5 month study period was observed along with very high OC, EC, CO, and NO_x levels; and the OC (as organic matter) was ~65% of $PM_{2.5}$ mass. Their levels were inversely proportional to wind speed. The second highest nitrate concentrations for the 9.5 month study period (maximum of 11.7 g/m^3) occurred when heavy fog developed.

$PM_{2.5}$ mass and APS particle number concentrations were strongly correlated during summertime PM events (A, B, C, D, and E) while the $PM_{2.5}$ mass was clearly associated with fine (0.01-0.45 m) particle number concentrations during the November stagnation episode (F). In addition, aerosols measured during the summertime events were more highly aged, as evidenced by larger accumulation modal diameters and the occurrence of far accumulation/droplet modes (~0.6 m), while those measured in the cold weather were mainly < 0.1 m (nuclei modes, e.g. emitted from traffic).

Fresh accumulation aerosols (modal diameters near 0.1 m) from a local power plant were observed on several occasions. This source induced a $PM_{2.5}$ increment of approximately 13 g/m^3 when its plume influenced the site. Excepting the Canadian smoke episode, emissions from the local region accounted for approximately 50% of $PM_{2.5}$ observed on the worst episode (June 25th). During episode A, time-resolved selenium and sulfate concentrations and air mass back trajectories suggest that an average of 53% of the sulfate excess over background be attributed to sources in the local region.

The results described here show that concentrations of $PM_{2.5}$ and its major constituents vary enormously on time scales ranging from <1 hr to several days, thus imposing a more highly complex pattern of pollutant exposure than can be captured by 24-hr integrated methods, alone. Lastly, local sources are shown to be major contributors to $PM_{2.5}$ episodes and transients, especially, in cooler months.

PUBLICATIONS (Cumulative)

Mitkus RJ, Powell JL, Zeisler R, Squibb KS, Differences in the biological activity of NIST Interim Reference Material (PM2.5) and NIST Standard Reference Material 1648 (urban particulate matter) in an in vitro assay system are due to metal content, In preparation.

Mitkus, RJ, Falconer, MO, Powell, JL, Ondov, JM and KS Squibb. In vitro assay of the biological activity of ambient PM2.5 collected by a high frequency aerosol sampler. The Toxicologist 66: 359, 2002.

Mitkus, R., Powell, J., Akkerman, M. and Squibb, K. Differential in vitro immunological responses to zinc (Zn), an active component of urban particulate matter (PM). Tox. Sci.

72 (S-1), 299, 2003.
Markus Pahlow, Jan Kleissl, Marc B. Parlange, John M. Ondov and David Harrison. Atmospheric boundary layer structure as observed during a haze event due to forest fire smoke, Accepted by Boundary Layer Meteorology.
D.A. Lake, M.P. Tolocka, M.V. Johnston, A.S. Wexler, "Mass Spectrometry of Individual Particles Between 50 and 750 nm in Diameter at the Baltimore Supersite," Environmental Science and Technology (2003) 37, 3268-3274
M.P. Tolocka, D.A. Lake, M.V. Johnston, A.S. Wexler, "Number Concentrations of Fine and Ultrafine Particles Containing Metals" Atmospheric Environment (2003) in press.
M.P. Tolocka, D.A. Lake, M.V. Johnston, A.S. Wexler, "Ultrafine Nitrate Particle Events in Baltimore Observed by Real-Time Single Particle Mass Spectrometry", Atmospheric Environment (2003) in press.
D.A. Lake, M.P. Tolocka, M.V. Johnston, A.S. Wexler, "The Character of Single Particle Sulfate in Baltimore", Atmospheric Environment (2003) submitted.
M. P. Tolocka et. al., Particle classes in Baltimore, to be submitted by the end of January to the special JGR issue.
Mariana Adam, Markus Pahlow, Vladimir A. Kovalev, John M. Ondov, Marc B. Parlange, Aerosol optical characterization by nephelometer and lidar during the Baltimore PM Supersite, 4 - 12 July 2002*, in revision following review for publication in* JGR Atmospheres.
Harrison, D., Park, S. S., Ondov, J. M., Buckley, T., Kim, S. R., Jayanty, R. K. M. Highly-time resolved particulate nitrate measurements at the Baltimore Supersite. Submitted to Atmos. Environ.
Park, S. S., Pancras P. J., Ondov, J. M., Poor, N. A New Pseudo-deterministic Multivariate

Receptor Model for Accurate Individual Source Apportionment Using Highly Time-resolved Ambient Concentrations Measurements, prepared for submission to JGR.

Park, S. S., Ondov, J. M., Carbon species and CO emission factors derived from the Canadian forest fires. To be submitted to the special JGR issue in January 2004.

Park, S. S., Harrison, D., Ondov, J. M., Seasonal and short-term variations in Nitrate concentrations. Seasonal and short-term variations in Nitrate concentrations.

Murray Johnston Group: Size resolved ultrafine particle composition analysis part 3: Baltimore, To be submitted to the special JGR issue in January 2004.

Mitkus RJ, Powell JL, Ondov, JM., Pancras, JP. and Squibb KS. Baltimore $PM_{2.5}$ daily and seasonal variations in *in vitro* stimulated chemokine and cytokine release: Correlation with metal content. In preparation

PRESENTATIONS/MEETINGS

UN ECE EMEP WORKSHOP

Ondov, J. M. New Pseudo-Deterministic Multivariate Receptor Model for Individual Source Emission Rates Using Highly-Time Resolved Data. United Nations ECE EMEP workshop on Particulate Matter Measurment and Modeling, by invitation only, New Orleans, LA. April 20-24, 2004

SUPERSITES PI's MEETING, 2004

Ondov, J. M., Nitrate Measurements at the Baltimore Supersite with the R&P 8400N, EPA Supersites PI Meeting, Las Vegas, February 25-26, 2004.

Ondov, J. M., Pseudo Deterministic Model for individual source apportionment using highly time-resolved measurements with SEAS, EPA Supersites PI Meeting, Las Vegas, February 25-26, 2004.

Ondov, J. M., The Supersites Integrated Relational Database, EPA Supersites PI Meeting, Las Vegas, February 25-26, 2004.

NARSTO 2004

Ondov, J. M., The U.S. Supersites Program: Overview and Selected Results. Presented at the NARSTO EA/ESC Meeting, Washington, DC, April 13-14, 2004.

INTERNATIONAL SOCIETY OF EXPOSURE *2003*

Sapkota, A.; Symons, J.M.; Kleissl, J.; Wang, L.; Parlange, M.; Ondov, J.; Buckley, T.J.; The Impact of Canadian Forest Fires on Air Pollution in Baltimore City: A Case Study of Long-range Pollutant Transport. 13th Annual Conference International Society of Exposure Analysis. Stresa Italy, 2003.

EGS-AGU, 2003

. Adam, M.; Pahlow, M.; Kovalev, V.; Ondov, J.; Balin, I.; Simeonov, V.; van den Bergh, H.; Parlange, M. Determination of the Vertical Extinction Coefficient

Profile in the Atmospheric Boundary Layer and the Free Troposphere" Presented at EGS-AGU, 6-12 April 2003, Nice, France

. Mariana Adam, Markus Pahlow, Marc Parlange, John Ondov, "Atmospheric Boundary Layer characterization during the Baltimore PM Supersite - July 2002" AAAR, 31 March - 4 April 2003, Pittsburgh, PAP11-16

Society of Toxicology Meeting, March 2003, 2004

R Mitkus[1], J Powell[1], J Ondov[2], and K Squibb[1]. Seasonal Metal Content Measured in Baltimore $PM_{2.5}$ SEAS Samples Correlates with Cytokine and Chemokine Release Following Exposure to Fine Particulate Matter in an *In Vitro* Assay System. Accepted for presentation at the Society of Toxicology Meetings, March 21-25, 2004.

R Mitkus, J Powell, M Akkerman and K Squibb. Differential Immunological Response of Two Airway Cell Types to Zinc (Zn), an Active Component of Urban Particulate Mattter (PM). To be presented at the Society of Toxicology annual meeting, March 9-13, 2003.

AAAR Meeting, March 2003 .

R. Mitkus, J. Powell, M. Akkerman, J. Ondov and K. Squibb Cytokine responses elicited by PM2.5 SEAS samples collected at the Baltimore Supersite during a 2002 intensive study. To be presented at the AAAR meeting in Pittsburg, PA, March, 2003.

Mitkus, R.J., Powell, J., Zeisler, R., Akkerman, M. and Squibb, K. Comparison of the biological activity of NIST interim reference material for $PM_{2.5}$ with NIST standard reference material 1648 for urban particulate matter. PM AAAR 2003 meeting "Particulate Matter: Atmospheric Sciences, Exposure and the Fourth Colloquium on PM and Human Health," Pittsburgh, PA., March 31-April 4, 2003

Shauer, J. J., Baie, M. S., Turner, J. R., White, W. .H., Koutrakis, P., Ondov, J. M., Pancras, J. P. (2003) New Insights into the dynamics of Sources of Fine Particulate Matter Using semi-continuous Chemical Speciation Samplers. Presented at the Association of Aerosol Research meeting, Particulate Matter: Atmosopheric Sciences, Exposure, and the Fourth Colloquium on PM and Human Health, March, Pittsburgh.

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